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Satellite tracking of female green turtles *Chelonia mydas* at Ma'Daerah Turtle Sanctuary, Malaysia

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ABSTRACT

Two KiwiSAT 101 satellite transmitters were deployed in July 2003 on female green turtle (*Chelonia mydas*) for the purpose of understanding their inter-nesting migration. The study was conducted at Ma' Daerah Turtle sanctuary in Kertih, Terengganu, Malaysia. The data received were analysed and plotted on to a digital map to estimate the travel points and distance travelled. The turtles roamed the water in the vicinity of nesting site and rarely travelled far during the nesting season. The furthest distant travelled to the sea (East) is approximately 42.4 km, to the South 44.4 km and to the north 7.8 km. Percentage of GPS location near (5-12 nm) nesting shore was 83.3% and far (>12 nm) was 16.7%. From this study, it is suggested that the strict/compulsory conservation boundary within the selected nesting site should be between 0-12 nm and additional 45 km for the outer boundary.

KEYWORDS: KiwiSAT, female green turtle, Terengganu

INTRODUCTION

The decline of sea turtles population is still a result achieved from a long term struggle to conserve it (Mortimer, 1990). Breeding adults were killed in incidental catch by fisherman or hit by speeding boats Mortimer (1990). Tisen and Bali (2000) found out that the inter-nesting resting areas lies within a kilometre from mainland where illegal trawling took place resulting in multiple incidental catch of turtles.

Studies on turtle migration has been done by numerous researchers for example Shiba et al. (2002) and Ibrahim et al. (2002). PTT transmitter was used as the main turtle locator and deployed on several female and male turtles to get the location of each and every turtles released. Arai and Ono (2000) stated the positive and negative side of using these platform terminal transmitters (PTT) as the data produced relied on several uplinks from the PTT before a good positioning of the turtle can be achieved. Previous studies showed that from all the data received from ARGOS, the satellite operators more than 50% were with minimum uplink i.e. one uplink giving no location of the turtle. However for the time being, this is the best method for collecting location data from released sea turtles.

A study was carried out by TUMEC (Turtle and Marine Ecosystem Centre, Malaysia) using PTT transmitter to determined the pre and post nesting of

green turtle at Ma' Daerah turtle Sanctuary, Terengganu Malaysia. This study was in conjunction with an education program run by TUMEC for an A level Matriculation students of Yayasan Satu Matriculation College. As a show of support to the turtle conservation activity the college students help raised some fund to purchase a PTT and satellite transmission services. The sum of money raised was RM 15,000.00. The PTT was then attached to a female green turtle and released by the deputy minister of education who officiate the opening of the program.

Recent study by Ibrahim et al. (2000) showed that the maximum radial distance from the nesting site travelled by a turtle during interesting period was 14.3 km. The speed of swimming was between 0.05 km/hour to 11.70 km/hour. The turtle were observed to stay offshore of her nesting site before completing her nesting activities. Bali et al. (2000) reported that it took 45 days post-nesting for a female turtle to swim a distance of 1506 km with average speed of 35 km/day.

Determination of nesting and inter-nesting area was also carried out using normal tagging fin data to see the degree of site fidelity. Tagging data of different nesting site along the coast of Terengganu were collected and compared. Proper fin tagging will last to as long as more than ten years and improper tagging and data recording

will expedite the tag loss. Now, in Malaysia, the main and most reliable tagging is using fin clip tag. Tagging activities in Terengganu were done by the Department of fisheries staff. Turtles observed during nesting activities were tag and recorded.

Observation on leatherback turtles showed that nesting site changes from one to different site following tidal current. In 2003 during leatherback nesting season a turtle was observed to nest at three different sites which were separated by at least 20 km (Pers. comm., fisheries assistant). The distance between nesting sites and the degree of site fidelity of a female green turtle has to be determined as this may affect the nesting protection zone and protection activities. For the purpose of understanding the behaviour of sea turtle during nesting and inter-nesting, a study was carried out using PTT satellite tracking and analysis of fin tags. The result can then be converted into actions for example proper monitoring, surveillance and protection.

Objective of this study

1. determine pre, post nesting position, the site fidelity and other possible nesting site using tag record and PTT data of green turtle from Ma' Daerah.
2. determine problems from using PTT and fin tagging for sea turtle study.

MATERIALS AND METHODS

Platform transmitter terminal (PTT)

Two PTT with serial number 38619 and 38620 were used to tag two female green turtles at Ma' Daerah, Terengganu. The PTT 38619 was tag to a female with fin tag number MY1615/MY1660 on the 6th of July 2003 and laid her eggs for the last time on the 20th July 2003. The second PTT tag (38620) was attached to a female green turtle with fin tag number MY 1005/1016.

The data from ARGOS were relayed from Dr Nobuaki ARAI from the Kyoto University, Japan through e-mail transmission. Data from 38619 were received starting 29th June 2003 until the 12th September 2003. The data transmission for 38620 were received between 7th August and 8th August 2003 for only two days.

The data received then got transferred to Excel program for analysis and sorting. This then got transferred to SURFER 6 program for plotting. The data were separated into three categories; a) all seaward data, b) LC's 1, 2 and 3 and c) all LC's 3 data. For plotting purposes also, all close up data and overlapping data were erased from the map.

A base map was created by scanning a section from British Admiralty chart 3543. The map was then overlaid with the position map using SURFER 6 program.

Tag data

Tag data from two different sites were compared to see the nesting site fidelity of the green turtle. The tag data was collected from Ma'Daerah and Cherating.

RESULTS

PTT Tagging

Data from PTT tagging were received from ARGOS via Kyoto University (Dr Nobuaki Arai) since 29 June 2003. After processing the data and using only the data with Location Class of 1, 2 and 3 a total of 34 data were used for 38619 turtle and 10 for 38620 turtle. All the data used were from August PTT transmission.

Positions which were on the mainland during the testing of the PTT were erased and selected positions plotted (Fig. 1).

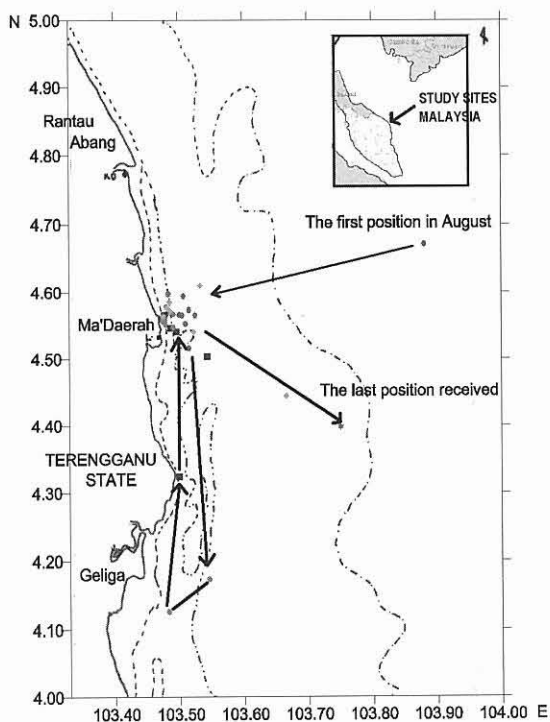


Fig. 1 Travel positions of the PTT38619 green turtle tag at Ma'Daerah Turtle Sanctuary

The LC3 data for PTT 38619 plotted showing the movement of the turtles (Fig. 2).

Data plotted for PTT 38620 showing the movement of the second female turtles (Fig. 3). Movement from the lowest position to the second position took 3 hours, 2 to 3 took 12 hours, 3 to 4 took 2 hours and 4-5 took 20 minutes

Location class percentages for PTT 38619 from 155 data were as Table 1.

Table 1: a) Percentages of Location class for PTT 38619, 38620

38619		
LC categories	No	%
LC3	57	36.8
LC2	16	10.3
LC1	15	9.7
Not good	67	43.2
Total	155	100
38620		
LC categories	No	%
LC2	1	8.33
LC1	2	16.67
LC0	2	16.67
LCA	4	33.33
LCB	3	25.00
Total	12	100

Fin Tag

Fin tag data for the year 2003 were collected from 2 sites, Ma' Daerah and Cherating Pahang. The data were analysed for number of nesting and major nesting site for each turtle base on the number of nesting recorded. From the tag data observed on females nesting at the study sites, both female with PTT tag did not land to nest at neither Ma' Daerah nor at Cherating. PTT location nearest to shore may indicate the female roaming the area but not landing to nest.

DISCUSSION

Tagging system

Observation in July and August showed that the data from PTT-ARGOS satellite system on turtle tracking was unreliable. After two months of deployment, most of the data received were within low quality location class. More than 155 dataset were received from the ARGOS satellite transmission but after selecting data set with proper positioning, a total of 155 dataset were used in this study which were from 1st to 31st August 2003. The best location class LC3 were 57 data set (36.8%), LC2 16 data set (10.3%) and LC1 15 (9.7%). The rest 43.2% were of LC0, LCA, LCB and LCZ. Overall approximately only 30% of the data were usable. When reflecting to the cost spent, this tagging system should be improved to increase the cost effectiveness of the money utilized.

The problem with this type of PTT were experienced during mounting and starting of the PTT. The PTT used did not respond, as it should in the manuals. It did not blink ten times during starting and the transmission detector did not give out the transmission beep at the same time. Due to this problem, the transmitter were dismount and remount twice for PTT 38619 and unluckily most of the LC3 data received were during the dismounting of the PTT in most the days in July 2003. The PTT 38620 was deployed and started but did not transmit

properly giving only 8 good LC in August and was never heard since.

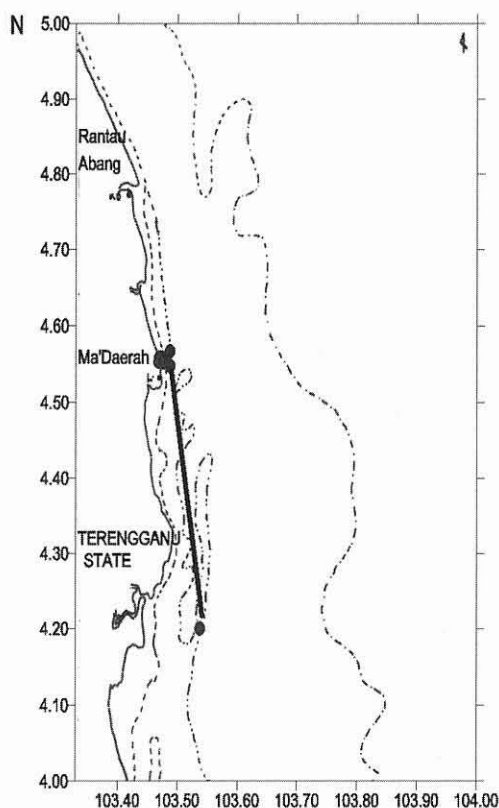


Fig. 2 The LC3 for the PTT38619 green turtle and the last position was approximately 40 km south from the nesting site at Ma'Daerah

Comparing the data from the PTT and inconel tag recorded from female turtle nesting no PTT attached females came up to the beach to nest in August at Ma' Daerah turtle sanctuary. Although most of the PTT's position were near the nesting site the turtle might probably just roaming the area before departing. From the inconel tag data, during the nesting season of Ma' Daerah from 31/3 to 28/9/2003, the PTT 38619 turtle had nested for seven times whereas the PTT 38620 turtle had nested only 3 times. But both did not come up to nest in August 2003.

PTT 38619 turtle started to nest on the 20th of May, 2nd June, 12th June, 21st June, 1st July, 11th July and 20th July. She laid her eggs seven to ten days apart from each nesting days. The last recorded nesting activity was on the 20th of July 2003. Due to problems in the starting of PTT the tag was not on any turtle until the 6th of July. When the location for this turtle was plotted, she was about to leave the nesting ground to the south (Fig. 1). This might indicate the probability of the southern part of peninsular was its grazing area.

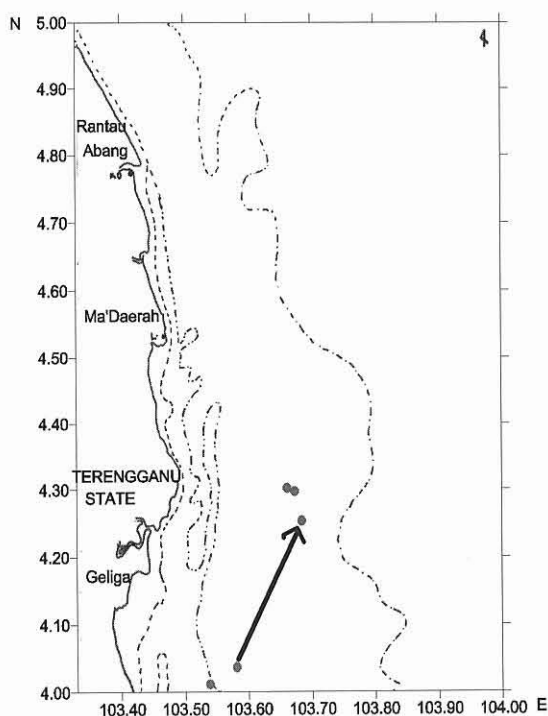


Fig. 3 Positions of PTT 38620 green turtle showing northward movement. These were position on the 7th and 8th of August 2003

PTT 38620 turtle started to nest on the 6th July, 17th July and 28th July. She only laid her eggs in July and the duration between her nesting days were eleven days. Unfortunately there were only twelve data received from this turtle. When the data were plotted, all locations indicated that the turtle was going northward from most probably Cherating, in the state of Pahang (Fig. 3). But landing was not recorded either in Cherating area or somewhere else in Pahang. These position showed that the turtles swam a far distance after nesting activities for an unknown reasons.

Nesting versus PTT observation

PTT positions were useful in detecting the movement of sea turtles but fin tag data was needed for confirmation of the turtle activities. Although the turtle were located near the nesting beach, it was confirmed that no nesting activities happened. The study also showed that there were no typical pre and post nesting activities for some of the turtles. Some might still be around the nesting sites for a duration of time before swimming away and some might swim away after a few nesting activities and the distance covered was quite far. The inconel fin tag on sea turtle was accepted by many as the tagging method of sea turtle but in some instances these tag did not last long as observation showed that there was three tag replacement

for a single turtle occur at Ma' Daerah. Human errors might be one of the factors as improper tagging resulted in tag lost. Snagging, fish bite and severed limb can also cause the turtle to loose its tag.

Summary/Suggestion

1. Development of new system of tracking system which can give better and reliable position should be developed.
2. System developed must also be cost effective.
3. Standardization of tagging method should be carried out.
4. Tag loss condition should be thoroughly examined.

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